REMARKS

Claims 1-56 are currently pending. New claims 49-56 have been added to enhance the scope of patent protection and are supported by original claims 12, 15, and 16, and page 5, lines 17-23, and page 7, lines 12-28. It is respectfully submitted that no new matter has been added.

The Patent Office objected to claims 6, 8, 9, 19, 20, 27, 29, 30, 34, 35, 36, 42, 44, and 45. Claims 6, 8, 9, 17, 19, 20, 27, 29, 30, 34, 35, 36, 42, 44, and 45 have been amended for clarification only and their amendment is supported, for example, on page 8, lines 10-22, and page 9, line 4, through page 10, line 27. It is respectfully submitted that no new matter has been added.

The Patent Office rejected claims 1, 3, and 10 under 35 U.S.C. 102(b) as being anticipated by Zhao, "A Novel Channel Estimation Method for OFDM Mobile Communication Systems Based on Pilot Signals and Transform-Domain Processing," IEEE VTC97-Spring, Phoenix, USA, May, 1997.

For a claim to be anticipated, each and every non-inherent claim limitation must be disclosed in a single reference. MPEP 2131.

Claim 1 recites, in pertinent part, as follows:

> transforming frequency domain channel estimates into the time domain; suppressing noise jitter in the time domain channel estimates; and transforming the noise suppressed time domain channel estimates back to the frequency domain for frequency domain equalization.

The Patent Office has asserted Zhao teaches the subject matter of claim 1 in Figure 2. Figure 2 of Zhao shows a received frequency domain signal Y(k) that may be expressed in terms of the product of transmitted signal X(k) and H(k) plus an interchannel interference component and the Fourier transform of the additive white Gaussian noise (page 2090, left and right columns; see especially equation 4). As noted on line 13, page 2090, the right hand column of Zhao, Zhao's goal is to estimate H(k) from the received pilot signals. Zhao, in equation 7, relates H dot N to H N where H dot N denotes the noisy transfer function. Section III of Zhao, starting on page 2091, provides an estimated transfer function through processing in a transform domain that is distinct from the frequency domain or the time domain disclosed in the left hand column, page 2090 of Zhao. In the processing of the transform domain, low pass filtering is performed

by setting samples in the high frequency region to zero (equation 11). The resulting G transform, as shown in equation 12 of page 2092, is used to generated the estimated transfer function, shown in equation 13.

Zhao uses h(n) to designate the transfer function in the time domain in equation 3. However, the frequency domain and transform domain both use upper case letters to designate the transfer function. Zhao discloses that "the argument p of the transform domain can be viewed as the "frequency" which reflects the variation speed of a frequency-domain function" (page 2091, right hand column, lines 14-17).

Zhao does not disclose or suggest the time domain processing recited in claim 1; namely, "transforming frequency domain channel estimates into the time domain; suppressing noise jitter in the time domain channel estimates; and transforming the noise suppressed time domain channel estimates back to the frequency domain for frequency domain equalization." Thus, Zhao does not anticipate claims 1, 3, or 10.

Furthermore, as to claim 3, Zhao's Figure 2 teaches the transformation from the transform domain to the frequency domain using an IDFT. In Applicant's invention, an IFFT is used to transform from the frequency domain to the time domain.

The Patent Office rejected claims 2 and 11 under 35 U.S.C. 103(a) as being unpatentable over Zhao, in view of Chiou, U.S. Published Patent Application No. 2004/0184399.

Chiou discloses a method for processing a RF OFDM signal transmitted from an OFDM transmitter (paragraph 0051). In discussing the background art, Chiou discloses channel estimation can be based on least square or minimum mean square (paragraph 0045). Chiou also discloses the use of comb-type pilot channel estimation (paragraph 0045).

However, like Zhao, Chiou does not disclose or suggest the time domain processing recited in claim 1; namely, "transforming frequency domain channel estimates into the time domain; suppressing noise jitter in the time domain channel estimates; and transforming the noise suppressed time domain channel estimates back to the frequency domain for frequency domain equalization." Thus, Zhao in view of Chiou does not make obvious claims 2 or 11.

The Patent Office rejected claims 4, 6, and 7 under 35 U.S.C. 103(a) as being unpatentable over Zhao, in view of Yamaguchi, U.S. Published Patent No. 2003/0227866.

As discussed above, Zhao does not disclose suppressing noise jitter in the time domain.

In addition to a time domain and a frequency domain, Zhao introduces a transform domain which is used to determine the transfer function in the frequency domain. One of ordinary skill would not look to Yamaguchi to modify Zhao because Yamaguchi does not disclose a transform domain separate from the time and frequency domains. Thus, claims 4, 6, and 7 are allowable.

The Patent Office rejected claims 5 and 9 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Wang, U.S. Published Patent Application No. 2006/0034363.

As discussed above, Zhao does not disclose suppressing noise jitter in the time domain. In addition to a time domain and a frequency domain, Zhao introduces a transform domain which is used to determine the transfer function in the frequency domain. Wang discloses a windowing technique in which v + 1 samples set to align with the tap of a Target Impulse Response filter in which taps outside the window of length v + 1 would be discarded (paragraph 0037), whereas claims 5 and 9 recite preserving the channel estimates at actual channel tap delays and setting the remainder to zero. One of ordinary skill would not look to Wang to modify Zhao because Wang does not disclose a transform domain separate from the time and frequency domains. Thus, claims 5 and 9 are allowable.

The Patent Office rejected claims 12, 14, 21, 23, and 31-33 under 35 U.S.C. 103(a) as being unpatentable over Zhao, in view of Klinski, U.S. Published Patent Application No. 2002/0057738.

Claim 12 recites, in pertinent part, as follows:

> A receiver comprising: a channel estimation interpolation function to suppress noise jitter over a bandwidth of interest, comprising a unit to transform frequency domain channel estimates into the time domain; a unit to suppress the noise jitter in the time domain channel estimates and a unit to transform the noise suppressed time domain channel estimates back to the frequency domain for input to said frequency equalizer.

Claim 23 recites, in pertinent part, as follows:

> a channel estimation interpolation function to suppress noise over a bandwidth of interest, comprising a unit to transform frequency domain channel estimates into the time domain; a unit to suppress the noise in the time domain channel estimates and a unit to transform the noise suppressed time domain channel estimates back to the frequency domain for input to said equalizer...

Claim 33 recites, in pertinent part, as follows:

> channel estimation interpolation means for suppressing noise over a bandwidth of interest, comprising means for transforming frequency domain channel estimates into the time domain; means for suppressing the noise in the time domain channel estimates and means for transforming the noise suppressed time domain channel estimates back to the frequency domain for input to said equalizer means...

Klinski shows a frequency equalizer 17 in Figure 2.

However, like Zhao, Klinski does not disclose or suggest the time domain processing recited in claims 12, 23, and 33 in which noise is suppressed in the time domain channel estimates which are then transformed to the frequency domain.

Thus, Zhao in view of Klinski does not make obvious claims 12, 14, 21, 23, or 31-33.

The Patent Office rejected claims 13, 22, and 24 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Klinski and Chiou.

As discussed above, none of Zhao, Klinski, or Chiou discloses or suggests the suppression of noise in the time domain channel estimates which are then transformed to the frequency domain.

Thus, claims 13, 22, and 24 are allowable.

The Patent Office rejected claims 15, 17, 18, 25, 27, 28, and 34 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Klinski and Yamaguchi.

As discussed above, Zhao does not disclose suppressing noise jitter in the time domain. In addition to a time domain and a frequency domain, Zhao introduces a transform domain which is used to determine the transfer function in the frequency domain. One of ordinary skill would not look to Yamaguchi to modify Zhao because Yamaguchi does not disclose a transform domain separate from the time and frequency domains.

Yamaguchi also discloses an adaptively computed threshold, but does not disclose or suggest a predefined threshold.

Klinski does not remedy the deficiencies of Zhao in view of Yamaguchi.

Thus, claims 15, 17, 18, 25, 27, and 28 are allowable.

The Patent Office rejected claims 16, 20, 26, 30, and 36 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Klinski and Wang.

As discussed above, none of Zhao, Klinski, and Wang discloses or suggests the suppression of noise in the time domain channel estimates which are then transformed to the frequency domain.

Thus, claims 16, 20, 26, 30, and 36 are allowable.

The Patent Office rejected claims 37, 39, and 46 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Langberg.

Claim 37 recites as follows:

> A computer readable medium encoded with a computer program for directing a computer to operate with a receiver of a multicarrier wireless communications system for performing channel estimation to suppress noise jitter over a bandwidth of interest, comprising operations of: transforming frequency domain channel estimates into the time domain; suppressing noise jitter in the time domain channel estimates; and transforming the noise suppressed time domain channel estimates back to the frequency domain for frequency domain equalization.

Zhao, as discussed above, discloses a transform domain, separate from the time and frequency domains, in which noise high frequency noise is zeroed out (page 2091, right hand column). Langberg has been cited to teach that the method may be implemented in software (column 3, lines 51-65) and does not remedy the deficiency of Zhao.

Thus, claims 37, 39, and 46 are allowable.

The Patent Office rejected claims 38, 47, and 48 under 35 U.S.C. 103(a) as being unpatentable over Zhao, in view of Langberg and Chiou.

As discussed above, none of Zhao, Langberg, and Chiou discloses or suggests suppressing noise jitter in the time domain estimates.

Thus, claims 38, 47, and 48 are allowable.

The Patent Office rejected claims 40, 42, and 43 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Langberg and Yamaguchi.

As discussed above, Yamaguchi does not disclose a predefined threshold of actual power in paragraph 0053. Also, Zhao is not modifiable by Yamaguchi because Zhao teachings are directed to a transform domain that is separate from the time domain or frequency domain.

Thus, claims 40, 42, and 43 are allowable.

The Patent Office rejected claims 41 and 45 under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Langberg and Wang.

As discussed above, Zhao does not disclose suppressing noise jitter in the time domain. In addition to a time domain and a frequency domain, Zhao introduces a transform domain which is used to determine the transfer function in the frequency domain. Wang discloses a windowing technique in which v + 1 samples set to align with the tap of a Target Impulse Response filter in which taps outside the window of length v + 1 would be discarded (paragraph 0037), whereas claims 5 and 9 recite preserving the channel estimates at actual channel tap delays and setting the remainder to zero. One of ordinary skill would not look to Wang to modify Zhao because Wang does not disclose a transform domain separate from the time and frequency domains.

Langberg has been cited to teach that the method may be implemented in software (column 3, lines 51-65) and does not remedies the deficiency of Zhao and Wang.

Thus, claims 41 and 45 are allowable over the prior art of record.

The Examiner is respectfully requested to favorably consider and allow all of the pending claims 1-56 as now presented for examination. An early notification of the allowability of claims 1-56 is earnestly solicited.

S.N.: 10/783,049
Art Unit: 2611

Respectfully submitted:

Walter J. Malinowski July 3, 2007

Walter J. Malinowski Date

Reg. No.: 43,423

Customer No.: 29683

HARRINGTON & SMITH, PC
4 Research Drive
Shelton, CT 06484-6212

Telephone: (203)925-9400, extension 19
Facsimile: (203)944-0245
email: wmalinowski@hspatent.com

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450.

July 3, 2007 Elaine F. Main

Date Name of Person Making Deposit